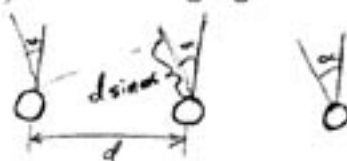


1. A linear array consists of three equally spaced hydrophones. The outputs are summed to produce a signal from a distant single frequency source (1183 Hz). The angle of arrival of the signals is  $\alpha$ . The distance between the hydrophones is  $d$ .



- (a) The arriving signal has an incidence angle of  $\alpha = 25^\circ$ .  
(b) The arriving signal has an incidence angle of  $\alpha = 39.35^\circ$ .



$$c = 1500 \text{ m/s}$$

$$d = 1 \text{ m}$$

$$\Omega_0 = (1183.101 \text{ Hz}) 2\pi$$

$$39.35$$

$$s(t) = \cos(\Omega_0 t) + \cos(\Omega_0 t - \frac{d \sin \alpha}{c}) + \cos(\Omega_0 t - \frac{2d \sin \alpha}{c})$$



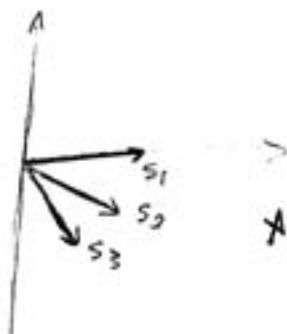
$$a \quad \alpha = 25^\circ$$

4.5 / 10

$$s_1(t) = \cos(7433.6 t)$$

$$s_2(t) = \cos(7433.6 t - (2.82 \times 10^{-4}))$$

$$s_3(t) = \cos(7433.6 t - (5.63 \times 10^{-4}))$$



$$b \quad \alpha = 39.35^\circ$$

$$s_1(t) = \cos(7433.6 t)$$

$$s_2(t) = \cos(7433.6 t - (4.23 \times 10^{-4}))$$

$$s_3(t) = \cos(7433.6 t - (8.45 \times 10^{-4}))$$

